Clean Airport Summit: Powering Operations with Alternative Fuels

Presented and Managed by Environmental Strategies: Consultants in Pollution Prevention, Inc.

Disclaimer: Due to time constraints, proceedings have not been reviewed by speakers for accuracy. Readers are encouraged to contact speakers directly if they desire additional information

DAY 1

Introductory Remarks: by Steven Howards,
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Opening Session - Plenary: Helping Airports Grow with Alternative Fuels

Introduction/Objectives

The goal of this Summit is to explore how to reduce pollution at the nation's airports and more specifically, how airports can grow cleanly through operations powered with alternative fuels. We are going to examine other "energy efficiency" strategies too, like shared transit, aircraft idling and taxiing, and engine technology; but the focus will be on powering operations with alternative fuels.

By operations I mean:
1) Landside vehicles like shuttle buses, rental cars, taxies, and service vehicles;
2) Airside vehicles like baggage and aircraft tugs and aircraft service vehicles;
3) Solar and natural gas applications for terminal buildings; and
4) Aircraft Operations, most notably, gate electrification, pre-conditioned air and reduced taxiing via AFV tugs
.
We will not be examining alternatively fueled aircraft. However, that's a subject that will be explored at a conference scheduled at Baylor University next month.

What were the origins of the Summit? Over the last several years I have worked extensively with both the DOE Clean Cities Program, the EPA Office of Air and Radiation, and the state and regional air quality regulators. DOE wants to see more alternative fuel vehicles (AFVs) on the road to reduce our nation's dependence on foreign oil. EPA and states are searching for reductions in every cubby hole, trying to meet the nation's ozone health standards.

How much do airports contribute to our cities' pollution problems? Extrapolating from data presented in a recent report completed for EPA by Energy and Environmental Analysis, Inc. of Arlington, VA; landside vehicles, airside vehicles and aircraft may contribute 2-4% of "metropolitan area emission inventories." Air traffic is the fastest growing transportation sector, with volume expected to increase over half by 2010. This combined with a ratcheting down of emissions

from other sectors required by the Clean Air Act, means that the relative contribution that airports make to overall emissions will increase over time. In terms of proportion, for NO_x, Aircraft (including the APU units) are responsible for about 43% of total airport emissions; 41% of landside vehicles (which includes total vehicle miles traveled to and from the airport); and about 16% for Airside vehicles. For VOCs, the breakout is 56% for landside; 31% for aircraft; and 13% for airside vehicles.

Air administrators are searching for reductions. With the President's recent commitment to toughened ozone and particulate standards, this search will intensify. In the East, some stationary source controls will push the technology costs exceeding $10,000 per ton. In California, costs could exceed $20,000 per ton. In contrast, many of the alternative fuel strategies that we will be looking at over the next couple of days use established technology that can actually yield significant pollution reductions at cost-savings to the operators. It is not difficult to see why airports are grabbing the attention of air administrators.

Some may wonder why regulators are so concerned about such a relatively small "piece of the pie." Let me try and put this in perspective: LAX airport by itself generates over 30 million pounds per year of ozone causing VOC and NO_x emissions. Logan generates over 13 million pounds, BWI over 7 million pounds, and Phoenix Sky Harbor over 11 million pounds. Just 4 airports generate over 60 million pounds of ozone causing emissions. U.S. airports generate hundreds of millions of pounds of ozone pollution annually, that is not to mention particulates, CO_2, and toxics. To help meet national health standards, air administrators must search for cost-effective measures anywhere they can find them. In California, they are regulating lawn mower engines and even that is not enough; they are now considering engine horsepower as small as 1.5 horsepower: weed-wackers and hedge-trimmers. The chemical composition of household paint and hairspray has changed to reduce ozone-causing emissions.

Now let's introduce this equation: airports that attract and generate huge volumes of vehicle traffic. Add aircraft, which together with locomotives are the largest unregulated sources of transportation emissions remaining in the United States. It is not hard to guess what is coming around the corner. I don't see any villains or bad-guys.

But I do see a great opportunity to avoid a collision. I do see a great opportunity to capitalize on the significant strides that many airports and airlines have already taken to reduce their emissions. Furthermore, this is a chance to identify other steps that can be taken, and to clarify specifically how we can work together as a team to move through issues that inhibit further progress.

EPA's recent airport study indicated that many airports and airlines have been proactive in the use of AFVs:

Why Airport Fleets Purchase Alternative Fuel Vehicles?

1) They provide a cost-effective response to potential regulations with minimal disruption;
2) they respond to percent reduction requirements imposed by local air requirements;
3) the threat of regulations has brought airports to focus upon least costly and disruptive strategies;
4) help save money for airlines and airports;
5) the projection of a "pro-environment" image; and finally;
6) the availability of funds to offset the incremental costs.

So given all of these motivating factors, why isn't the use of AFVs even more widespread at airports? Why aren't alternative fuels playing a greater role in powering terminal buildings? Why are there not more gate electrification and more use of pre-conditioned air versus APU's? And if energy efficiency strategies can save airlines money and they are operating in such a competitive environment, why aren't those approaches more widespread?

Those are some of the questions I hope we will begin to answer over the next few days. The Plenary session will examine the impact of Federal laws on airport and air quality planning; the benefits of various airport pollution-control options. The breakouts will cover opportunities for pollution reduction, lessons learned, and problem areas. The Summit then will close with an afternoon of "brainstorming sessions" where we will define a "near-term" agenda for addressing the primary issues that hinder the implementation of landside, airside, and aircraft operational strategies.

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Session I - Plenary: National Regulatory Initiatives: Impacts on Cleaner Airport Operations

Introduction

"Airports are like small cities." They emit pollution from typical stationary sources, and they are an enormous source of emissions from vehicles and aircraft. It is our hope that state, federal and local agency representatives here today can affect real change.

Framing Environmental Issues in Massachusetts
More than 750,000 people in Massachusetts suffer from respiratory illnesses. For many years policies have been successfully targeting emissions reductions from large industrial facilities and power plants. As a result, autos are the largest source of pollution in the state. Also, Massachusetts has a challenge to reach established air quality goals--choosing cleaner, more efficient forms of transportation is a viable option.

Airports and Air Quality:
Airports are one of the many sources of pollution that state agencies cannot pursue because they are governed by the federal sector. Despite this limitation, states are responsible for the emissions produced at these facilities. Compared to many other sources, airports lack comparable emissions reduction efforts.

Particularly in light of more recent stringent air quality standards, federal agencies, such as the Federal Aviation Administration (FAA), must look more closely at options for reducing emissions at airports. FAA has not been particularly helpful at reducing emissions. Perhaps this is because the agency's main objective is maintaining and ensuring safety. "We need to urge the FAA to think more broadly."

Furthermore, there is willingness within the airline industry to reduce emissions, but airlines need more incentives, leadership, and guidance.

Efforts within Massachusetts
With the leadership of former Governor Weld, the Clean State Initiatives was implemented, leading to greater environmental planning. Most important, this effort takes into consideration forecasts for increases in the projected number of vehicles within the confines of current emission standards. The state is capped at current levels despite projected increases. Thanks to state leadership from the top down, various innovative projects have begun at Logan Airport to reduce the emissions inventory.

Among projects initiated at Logan Airport a regional, fast-fill, public CNG station has been built, and 11 electric vehicle charging stations have been added to the airport. State agencies are using a variety of different fuels, and airport users have gotten involved. For instance, American Airlines has purchased electric ground service equipment. Avis is using CNG minibuses. Two electric buses are being designed for cold weather use, and the post office has added an electric van. Boston Edison has provided electric taxis, and the Hudson Company is trying new ground service equipment on electricity and CNG.

Finally, more airlines need to get more involved in using alternative fuels. Using AFVs will save them money. If the airline industry doesn't take action, it will likely face activism from state and environmental groups to get federal agencies to lead the way, most likely through regulations. Airlines should prefer to do it themselves.

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- Fleet Requirements
- Alternative Fuel Policies

The Energy Policy Act (EPACT) of 1992 gave DOE specific goals to reduce dependency on imported petroleum: 10% by 2000 and 30% by 2010. Alternative fuel goals under EPACT need to be met and thus there are acquisition requirements. Airport AFVs can help states meet their EPACT AFV acquisition requirements. Furthermore, airports are highly visible and can serve as major hubs for education about alternative fuels to the public and fleets.

There are a few carrots for purchasing AFVs—there are tax credits available for infrastructure and small grant programs for vehicles, primarily given to Clean Cities coalitions. Clean Cities can also help local efforts to build markets for alternative fuels.

The energy security, climate change, and economic benefits of alternative fuels may seem somewhat abstract. Talk to your local counterparts who are making the effort to promote alternative fuels, cleaning the air, improving national security, and still meeting or even beating the bottom line.

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- **NAAQS**
- **Emissions Inventories**
- **Impact on Attainment Planning**
- **Air Quality Benefits**

Introduction

EPA is working with state and local partners to improve air quality. Airport activity can represent up to 10% of a city's emissions, or even more with vehicle travel. Airports are the highest growing sectors of some cities' economies therefore emissions are expected to also grow significantly. On the other hand, airports represent cities; they serve as a showcase of the city's environmental conscience and economic success.

On the positive side, airports have planning structures in place that can facilitate emissions management. Innovative clean-up efforts can obtain a great deal of positive public reception. New forms of mass transit, new technologies, innovations proven through a "clean airports process" can be models for other sectors.

Summary of Regulatory Actions

There are proposed stringent new emission standards for nonroad diesel engines. Two million heavy-duty trucks are off-road. EPA plans to introduce a non-road gasoline vehicle proposal in late 1998 or early 1999.

Also interesting to note is that the Southern California SIP includes an MOU with the airline industry for cleaner ground service applications. This demonstrates the feasibility of ultra-clean operation of ground service equipment.

Additionally, EPA is expected to finalize a National Low Emission Vehicle program, which will establish voluntary nationwide standards to make new cars significantly cleaner. The program, however, needs agreement between the automakers and EPA.

New NO_x and NMHC standards were implemented in 1994 for new on-road heavy-duty vehicles and will be tightened again in 1998. These new standards will significantly reduce emissions from heavy-duty vehicles.

EPA Efforts to Reduce Compliance Costs

EPA has begun a Clean Air Investment Fund. Under this plan, polluters, after significant efforts, may still face additional control requirements. If further measures exceed an established threshold, contributions may be made in lieu of additional control measures.

In addition, states will also be allowed to take credit for voluntary measures in their State Implementation Plans. Airports may want to generate emission credits to offset emissions from expanded measures

Interested parties should help EPA identify and address obstacles and barriers. “This is an ideal opportunity to foster partnerships. Let’s take advantage of the fact that efforts need not be driven by regulatory efforts.”

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- **Airport Air Quality Initiatives**
- **Congestion Mitigation and Air Quality**
- **Conformity**

Introduction

The conformity rule was enacted in the Clean Air Act Amendments of 1977, Section 176[C] of the Clean Air Act. It says: No Federal agency shall "engage in, support in any way or provide financial assistance, license or permit or approve any activity which does not conform" to a [State Implementation Plan].

1990 Amendments

Federal activities must conform to the "purpose of the SIP" (i.e. help attain national ambient air quality standards). Activities must not cause or contribute to new violations of any standard and they must not increase the frequency or severity of violations or delay timely attainment or maintenance of standards.

Conformity applies to nonattainment and maintenance areas only under the National Highway System Designation Act of 1995.

EPA Rules on Conformity

Transportation conformity applies to highway and transit activities federally funded or approved by FHWA or FTA and to regionally significant highway and transit projects, regardless of funding source [40 CFR, Parts 51 and 93]
General conformity relates to all other Federal actions [40 CFR, Parts 51 and 93]

The goal of conformity is to ensure that federal agencies consider air quality in making decisions about their activities, and that air quality considerations are part of the transportation planning process.

Some airport access projects may be covered by both rules. This depends upon the nature of the project and what Federal funds or approvals are involved.

General Conformity

The federal agency makes the conformity determination. Usually individual actions are reviewed. Conformity analysis is performed when action is not exempt and when direct or indirect emission levels exceed "de minimis" thresholds in the regulation. Conformity analysis is usually done with a NEPA

environmental review. Typical FAA actions needing conformity analysis are new airports, new runways, and airport access projects.
General conformity must address direct and indirect emissions which are caused by the action and which are reasonably foreseeable. It must also address indirect emissions, which can be practicably controlled by the Federal agency through its continuing program responsibility.

Under general conformity, Federal agencies must meet one of these tests:

- the total of the direct and indirect emissions from the action are offset through a SIP revision; or
- the local or area analysis for CO, PM-10 in the lead nonattainment areas show no new or worsened violations; or
- the state commits to revise its SIP to include the action; or
- the action causes no net increase in emissions over the baseline; or
- the action is accounted for in the metropolitan area's transportation plan and transportation improvement program.

Transportation Conformity
State air quality plans contain emission reduction targets by source category, including on-road mobile sources.

Transportation conformity compares total highway and transit emissions in a metropolitan area to SIP transportation emission targets. Conformity analysis is done by the metropolitan planning organization for the area and approved by Federal Highway Administration (FHWA) and Federal Transit Administration (FTA). Under both Transportation Conformity and Metropolitan Transportation Planning regulations, FHWA/FTA funded/approved projects cannot go forward unless they are on the "conforming" transportation plan and Transportation Improvement Plan (TIP), and project analysis does not predict violations. The Clean Air Act and Intermodal Surface Transportation Efficiency Act (ISTEA) work together to ensure coordination of metropolitan transportation planning process and the air quality planning process.

Transportation Conformity—"Nonfederal" Actions
This applies to sponsors, which receive Federal highway or transit money. Regionally significant projects such as airport access must be in the emissions analysis for an area's conforming transportation plan and TIP regardless of the funding source used. If a project is not in the conforming plan and TIP, a regional emissions analysis must show that the regional projects as a whole would still conform when the new project is included in the analysis.

The purpose of this provision is to be sure that all major transportation activities are reflected in the regional emissions analysis. Project sponsors must notify the MPO of a planned project so it can be included in the MPO's regional analysis.

Airport Initiatives
Under the FAA, funds are available under the Airport Improvement Program (AIP) for airport construction, repair or improvement and certain capital equipment needed to comply with the Clean Air Act or certain other environmental requirements [49 USC 47102 (3) (f)]. Passenger facility charges (PFCs) may also be used to help sponsors meet Clean Air Act requirements. To be eligible for PFCs, projects must also preserve or enhance safety, security and capacity of the national air traffic system.

Possible Airport Actions to Reduce Emissions
Projects to reduce use of auxiliary power units through construction of electric and air conditioning services at gates are potentially eligible under the AIP or PFC programs. Conversion of ground service equipment to alternative fuels is a useful strategy, but is generally the airlines' responsibilities.

Other projects that qualify are refueling facilities for AFVs or recharging facilities, if they are part of terminal construction. Improvements to airport access and circulation systems may also be eligible.

Resources Available
FAA is planning an "advisory circular" to assist airports in planning airport actions to reduce emissions. Both FAA and FHWA jointly developed an intermodal ground access planning guide. In addition, DOT published a proposed airport access policy that encourages coordination of airport and metropolitan transportation planning.

ISTEA and Reauthorization
ISTEA was a landmark piece of legislation that emphasized flexibility for states and local communities in choosing the best transportation solutions to meet their needs. It authorizes federal funds for highway and transit improvements and intermodal connections. It stressed protecting the environment while continuing to create a transportation system that enables the economy to compete abroad and to create jobs at home.

Furthermore, ISTEA created a special program to help areas meet air quality standards, the Congestion Mitigation Air Quality improvement (CMAQ) program, and set aside "transportation enhancement" funds for communities to carry out projects that protect the cultural, aesthetic and recreational aspects of our transportation system. ISTEA's authorization ended Sept. 30.

The NEXTEA was proposed earlier this year to continue ISTEA's successes NEXTEA continues the emphasis on intermodalism, flexibility and environmental protection.

Congestion Mitigation Air Quality Improvement Program (CMAQ)
CMAQ was created by the ISTEA to fund transportation projects and programs to help achieve and maintain national ambient air quality standards for ozone, CO and PM-10. CMAQ funds a range of transit improvements, demand management activities and alternative fuels programs.

Specifically, alternative fuels programs which may be funded include conversions of public fleets included in the SIP, construction of refueling stations, and purchase of clean fuel buses.

The administration's proposal, NEXTEA, proposed continuing CMAQ with an increase to $1.3 billion annually. (The current level is $1 billion per year.) Eligibility would be expanded to include areas failing to meet new air quality standards. Both House and Senate bills continue CMAQ, but the House bill allows states to transfer some funds to other uses

Session Q&A
How quickly can we expect the federal sector to address these issues?

Tom Gross - DOE recognizes that the urgency is there and appreciates the automakers' initiative to bring vehicles to market. There is still a practical issue of providing adequate infrastructure. DOE will continue to press harder in Clean Cities program to develop "nodes" - strategically establishing infrastructure and vehicle throughput. These "nodes" should lead to expanded corridor infrastructure. The Congressional mark for these efforts not as high as hoped - which will inevitably slow the effort.

Don Larson - EPA has efforts in place for airport equipment (non-road) service equipment. But, this is a small piece of the pie. The bigger piece is the aircraft. The airline industry is international; standards are set at an international forum. (Even slower than federal process).

Camille Mittleholtz - Programs are in place at a federal level to put more efficient transportation efforts in place. Programs are geared toward local choice. It's a matter of the local decision-makers choosing to take advantage of these opportunities. In the long term, DOT is concerned with these efforts' impacts on the economy. The federal sector needs to learn more about emission sources and what needs to be done to regulate them. This will take us well into the next decade, next century.

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Session II: How Alternative Fuels Can Help Reduce Airport Emissions

Introduction

This discussion is geared to fleet managers, airport operators, and government officials.

The main areas where opportunities for cleaning up emissions at airports exist are fuels, terminals, traffic, gate operations, and other landside and airside operations.

Other Points

- Air Quality is a public health issue
- [In California, the State Implementation Plan became the driver for AFVs through the California low emission vehicle program.

Public/private partnerships can help finance AFV projects. In addition, voluntary action should be recognized and amplified—alternative fuels should be sold on their economics.

Why target airports?

Not only are one in every 15 jobs related to civil aviation, but airports are also a focal point for fleets. Moreover, airport vehicles are capable of central refueling. Airports are opportune for AFV use as a result of their large amounts of pollution, their highly visible locations, and their significant number of private and public fleets.

CALSTART Projects--Deployment Planning—Austin and LAX

At Los Angeles Airport (LAX), transportation control measures failed because the program was completely voluntary. The Federal and State Implementation Plans preceded these activities in California.

Currently, LAX has 2,200 vehicles. Of these, 1,134 are gasoline-powered, 540 run on diesel, 292 on compressed natural gas, 12 run on liquefied petroleum gas, and 222 are electric-powered. United Airlines is the largest user of LAX's electric charging sites. In addition, a liquefied natural gas (LNG) station has been set up for buses.

In Austin, TX, the city is not in attainment of air quality standards. Twenty-one fleets have been identified at the airport. Currently, AFVs are being used voluntarily. Work is being conducted with the Texas General Land Office and the Texas Railroad Commission. The current alternative fuel issues being considered in Austin are infrastructure availability and costs. The airport is using gate refurbishing for energy reduction. The airport in Austin has some natural gas runway sweepers as well as electric, natural gas and hybrid buses.

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The Problem: Emission Reduction and Cost Effectiveness
Currently, there is no comprehensive inventory of ground service equipment and alternative fuels projects. Moreover, there also is no current systematic assessment of projects in place.

The Need
Industry and government need an assessment of potential emission reductions AFVs at airports offer. In addition, an overall strategy is needed for guidance at airports.

What is the Plan?
Information on current AFV projects and must be gathered and combined with an analysis of low emission technology options, costs, and infrastructure issues. An integrated evaluation of potential emissions reductions from alternative-fuel ground service equipment needs to be provided. Also, a list of guidelines needs to be established for implementation of projects. Policy options need to be assessed to best obtain reductions.

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Introduction

Maryland's air quality ranges from marginal to severe. Therefore, a strategy needed to be developed to accommodate emissions reduction. Alternative fuel vehicles (AFVs) can play a large potential role in the state's air quality strategy.

Maryland Dept. of Transportation is a multimodal transportation agency, including aviation, motor vehicles, highways, ports, transit (rail and bus), and toll roads.

Maryland's Approach to Air Quality Issues

Maryland is primarily looking at programs that promote behavioral changes, such as telecommuting, greater use of public transit, ridesharing, and bicycle transport.
Since behavioral changes are particularly difficult to implement, Maryland DOT's focus is to encourage behavioral change through implementation of non-behavioral changes such as tolls, and encouraging the use of AFVs.

Maryland alternative fuel activities to date include: installation of 35 compressed natural gas (CNG) stations (of which 16 are semi-private or public); passage of alternative fuels tax incentive programs; Clean Cities program participation; a CNG taxi cab emissions measurement program; and activities in DOE's Northeast Clean Corridor.

Successes at Baltimore-Washington International Airport (BWI)

BWI is a major transportation hub/node. It is currently operating, 25-30 airport parking shuttles on CNG. In addition, Baltimore Gas and Electric owns and maintains a CNG station at BWI. This station has the greatest throughput of the 35 stations in the state.

The state has pursued this strategy at the airport because transition to alternative fuels was less expensive than other options. No behavioral changes are required for this option, and the strategy creates measurable emissions reductions. Moreover, owners of the vehicles can say money.

Issues to Study When Considering AFVs at Airports:

- infrastructure and maintenance support;
- potential use of emissions reduction credits;
- funding sources;
- OEM availability;
- acceptance by EPA;
- Confidence in estimates of emissions reductions;
- and types of vehicles to pursue.

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Introduction

I am not here to just glorify alternative fuels, but to look at the obstacles, the costs, and the possible benefits.

Airport emissions can be a significant contributor to the total non-attainment regional inventory of HC, NO_X, and PM-10. These emissions are derived from three main sources: aircraft; ground service and ground access vehicles. Aircraft emissions include those emissions under the inversion height ceiling as well as auxiliary power unit (APU) emissions. Ground access vehicle emissions include the entire trip emissions, not just within airport boundaries

Ground service equipment (GSE) includes all aircraft support equipment when at the gate including the auxiliary power units, which provide preconditioned air and power to gated aircraft.

Major reasons to focus on control of GSE/APU emissions:

- they involve no aircraft safety issues;
- they have the lowest cost emissions reduction potential; and
- control alternatives are available now;

Use of Alternative Fuels

Currently most GSE use gasoline or diesel fuel while APUs use jet-fuel. Most GSE and APU engines are unregulated for emissions. The major alternative

fuels that may be used in these operations are electricity, natural gas and liquefied petroleum gas.

- APU use can be minimized by gate based air conditioning and 400 Hz electric power.
- GSE conversion to alternative fuels involves engine conversion for compressed natural gas (CNG) or LPG, or new models for electric usage.

Gate Based Equipment

The current system of gate based air conditioning and power is already used in several airports. Decentralized gate based units are the least cost strategy, especially with today's hub-and-spoke systems when all gates in a terminal are used simultaneously.

As soon as a plane is parked at the gate, a ground crew can plug in the aircraft to gate power and attach a hose to provide conditioned air. However, the APU must be started 5 minutes before "push-back" to perform pre-flight checks and to start the main engines, so that all use of APU at the gate is not eliminated.

Economics of Gate Based System

The typical first cost of a gate-based system is $24,000 for electrical power and $38,000 for air conditioning for a narrow body gate and twice that for a typical wide body gate.

Operating costs for electrical power and air at the gate is $4.70 per hour, including maintenance. By contrast, an APU costs $41.00 per hour for a narrow-body aircraft, as it requires high maintenance.

Approximate savings per hour of APU avoided time is about $29. For a typical gate use of 6 to 7 hours per day, first costs are paid back within 1 year, and emission reductions are "free."

Ground Support Equipment (GSE)

Three types of equipment dominate in terms of total emission and populations: baggage tug, belt loaders, and aircraft push-back tractors. Other GSE such as refueling trucks, water trucks, and catering trucks use emission controlled on-highway engines, so their contribution is small.

Baggage tugs can be diesel or gasoline powered, belt loaders are gas powered, while aircraft push back tends to be diesel powered. The economics for baggage tug conversions for alternative fuel use are similar to other GSE types. The primary problem with conversions is that they may have higher emissions if improperly converted.

Baggage Tug Baseline

An analysis of the bag tug economics at a site will provide insight into the cost/benefit of this emission control strategy. Gasoline engine powered tugs are the lowest first-cost option, but have high fuel and maintenance costs. Emissions of HC and CO are high and engines need to be replaced every 4-6 years.

Diesel tugs have a higher capital cost relative to gasoline tugs but substantially lower fuel and maintenance costs. Emissions of NO_X and PM-10 are high but engines will last 8 years to rebuild.

Typically, bag tugs at airline hubs are used intensively for 7 to 8 hours per day. However duty cycle has a lot of idle time between loading and unloading operations.

Alternative Fuel Options

Baggage tugs can be converted to operate on CNG or LPG. Electric baggage tugs are also available as replacements. All three are commercially available.

Conversion of existing gasoline engines to CNG or LPG is relatively easy and involves adding a new fuel system and tanks. These vehicles may retain their dual fuel capabilities.

However, conversion of a diesel engine to operate on CNG or LPG is difficult and requires converting a diesel engine to gasoline by adding spark plugs and lowering the compression ratio. Dual fuel capability is lost. Factory-built conversions have become available recently. Conversion to electric operation requires changing the entire drivetrain.

CNG/LPG

Conversion kits are available to convert gasoline tugs to CNG or LPG operation. The typical cost for LPG is $1,500 to $2,000 with a tank holding 20 gallons. CNG costs are $4,000 or more mainly due to high-pressure tanks that can hold 15 gasoline gallon equivalents.

Relative to a gasoline engine, LPG can reduce NMHC and CO emissions by 50 percent and NO_X by 25 Percent. CNG can reduce HC/CO even more by 60-70%. However, this assumes a high quality emission calibrated installation that is generally not the case.

Factory built diesel engine CNG conversions reduce NO_X by 35-50% and PM-10 by about 100% relative to diesel. However, CNG engines in the 80 (plus or minus) 15 HP range are not yet available, and costs of CNG engines of 250HP are very high. OEM CNG engines are currently very expensive.

Operations
CNG and LPG problems in operations are related to refueling. The issues are availability of refueling stations, rate of fill, and range limitations of CNG. Since all refueling occurs during airport shutdown, station utilization is low. A CNG refueling facility capable of servicing 60 to 70 percent bag tugs will cost $800,000 to $1 million.

Some GSE managers have complained of a lack of vendor engineering support during breakdown, but these problems may be associated only with specific vendors. Many of CNG's refueling issues may be avoided with LPG but emission benefits are smaller with LPG relative to CNG.

Electric Tug Issues
The first generation of these machines was not very good. They were plagued with inefficient motors and batteries; the vehicles were under-powered and not liked by drivers.

Newer, second generation tugs have more advanced motors/controllers and better batteries, so that overall performance is better, and reliability is improved. Since EVs consume no fuel at idle, energy and fuel cost savings are significant. Up-front costs for these tugs are about $30,000, but batteries must be replaced at least every 4 to 5 years.

Electric Tug Operations
Newer, second generation electric tugs can replace conventional tugs on a one-for-one basis in load hauling capability. Top speed and gradeability are restricted but no major issue. Battery maintenance is essential to achieving 4-5 years, especially with current lead-acids. However, these electric tugs cannot operate for full the 15 hours per day required. Charging at off-peak times is required. If there is a significant conversion to electric GSE at a facility, electric supply infrastructure may need a major upgrade.

Alternative Fuel Cost Benefit
Diesel bag tugs have the lowest lifetime cost of all engine tugs but with high NO_X and PM10. LPG is the next least-cost option, offering substantial reduction in lifetime tons of NO_X/PM-10 relative to diesel but increased HC/CO emissions. By contrast, CNG and gasoline engines have similar lifecycle cost, but CNG offers significant benefits in all emissions relative to gasoline. Electric vehicles can have the lowest lifecycle cost if battery life goals and reliability goals are attained in practice.

Long Range Goals
The ultimate goal is a "vehicle free" gate with pop-up refueling, portable water, and toilet services, baggage delivered by central conveyer belt to the gate, food service from holding room at the gate, fixed gate based power/air conditioning

and an electric track for aircraft pushback. This type of system is already operational in Arlanda, Sweden with good performance and reduced labor costs. Ideally, such a system should be designed into the airport because retrofit is difficult.

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Session III: Funding Opportunities for Alternative Fuel Vehicles

James Cannon

Federal programs only work if state and local participation occurs. The majority of states have incentives for alternative fuel use. State and localities have been working hard on alternative fuels.

Several states have established an income tax credit covering the front end capital costs of alternative fuel equipment. Examples: Colorado has rebates for non-tax paying organizations. Meanwhile, a handful of states have loan programs; 10 states reduce fuel taxes; and a few states offer special privileges to early adopters of new technologies.

We are trying to figure out how these programs can be matched at the federal level.

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The Seattle regional office is responsible for 7 states in the Northwest. The field offices work directly with airports. The branch is responsible for funding decisions in the region—planning/programming airports, airport design and development, funding, and safety. FAA headquarters makes the final decisions on eligibility under these programs.

Airport Improvement Program

FAA Financial Assistance Programs

FAA administers two programs under which alternative fuel vehicles (AFVs) might be acquired. These two programs also account for all FAA's support for the airport owners. The AIP is a grant program. Entitlement funds can go pretty much to what the sponsor wants to fund. Discretionary funds are approved using a priority system. All funding approval is expected to go to high priority work enforced through FAA approval of discretionary money.

The Passenger Facility Charge requires airlines to review concurrence and FAA approval. These funds are considered local funds with limited government strings.

Annual Funding

Areas not in nonconformity have a funding level of $355 million based on current appropriation estimates. The amount per airport covers all AIP support. (The discretionary amount is approximate.)

The current funding levels:	**$1.7 billion**
Local Municipal, State Airports	$140 million
Entitlement	$355 million
Range	$1-16 million
(Depending on size of airports)	
Discretionary	$300 million
Passenger facilities charge program	$1 billion

Title 49 USC 47102(3) F

The definition of a project includes airport construction and the purchase of capital equipment. If necessary for compliance of the airport operations with the Clean Air Act Airport Improvement Program a passenger facility charge is added.

General Eligibility

	AIP	**PFC**
Clean Air Act Compliance	yes	yes
On airport ground access	yes	yes
Terminal buildings	yes	yes
Terminal gates	no	yes

Airport Project Coordination

Airport projects eligible for this funding must be consistent with MPO policies.

Airport Improvement Program--Air Quality Enforcement

AIP/PFC General Eligibility

Currently there are two programs with similar eligibility provisions. Both require Clean Air Act compliance. They include access to the airport, such as roads and transit to support runways, used exclusively by the airport passengers.

Eligibility Examples
Fixed central power and air conditioning, construction of a new terminal, and improvements to existing terminals (if the changes mitigate air pollution) are all examples of eligible projects. Approval of these projects is conditional on the sponsor's compliance with applicable air and water quality standards in operating the airport.

Coordination
Projects that may affect air quality should be incorporated in the regional transportation plan.

Priority System for Projects
Safety is the first and highest priority. Preservation of the infrastructure is next, (and as with highways, this is very expensive); and then the Apron; (could include APU alternatives). Vehicles (e.g. snow plows) also are similar in priority to AFVs, if they are in accordance with CAA mandates. Any mitigation requirement has the same priority as the basic project for which mitigation is required.

AIP Priorities (100=best)

Improve runway safety area	97
Rehabilitate Runway	72
Construct Apron	56
Acquire Vehicles (snow removal)	48 (same for AFVs)
Construct access road	23

In summary, FAA has two financial assistance programs. Access is the most significant expenditure. Funding for terminal improvements are allowed. AFVs are also eligible if they are included in the SIP. No money has been specifically earmarked for certain projects, and FAA has limited experience with this new program.

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Congestion Mitigation Air Quality Improvement Program (CMAQ)
CMAQ is a $6 billion program that was available over the life of the Intermodal Surface Transportation Efficiency Act (ISTEA). It is set up so that funds are available for nonattainment and maintenance areas. CMAQ funds projects and programs to help achieve and maintain NAAQS for ozone, CO and PM 10. Apportionment of funding to states is based upon the population in ozone and carbon monoxide (CO) nonattainment areas

Projects Eligible for CMAQ Funding
Projects eligible for CMAQ funding include transportation control measures as defined in the SIP, improved transit service, bike and pedestrian facilities, traffic flow improvements, intermodal projects, demand management, inspection/maintenance programs and alternative fuel vehicles (AFVs).

Overview
Transit and traffic flow projects have received the majority of funds; AFVs comprise nearly 6%. To be eligible, a project must be included in a SIP or under the Clean Fuel Fleet Program

Good Ideas for securing CMAQ money
To increase chances for funding, DOT strongly suggests creating public/private partnerships. Also, state ownership of refueling facilities and equipment, using EPA certified engines and conversion kits and knowing your metropolitan planning organization will help applicants.

There is program guidance prepared on CMAQ updated in 1995 that has encouraged non-traditional projects--if you show that it will improve air quality and get MPO to support, you may have a chance.

A special formula fund has been set up for nonurban areas and funds for meeting disabilities act requirements.

Nondiscretionary grants are given for modernization, buses and bus related equipment, and other areas. AFVs are eligible for the bus funds, and

maintenance and refueling are also eligible for funds. The funds normally go to the transit agency. You may look for airports generating emissions and have clean fuel buses provide service to these airports.

There are two types of transportation programs. Highway programs include the national highway system—that is interstate roads and projects of national significance. Second is the surface transportation program, which covers a wide range of projects: HOV lanes; carpool and van pools; traditional highway; and bike and pedestrian programs.

CMAQ is under the highway end of the program. The planning process is an important part of this type of funding. ISTEA made changes to the planning process but the process now emphasizes transportation and environmental factors. Long-range (20-year plans) are used to identify the ways projects are approached. The plans look at consistencies in transportation, energy environmental and social factors. DOT has published a draft airport-policy statement plan that will be out in the next 6 months.

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Introduction

Why do airports attract attention? Airports attract funding for alternative fuel projects because of their density, multiple vehicle uses and access to central refueling. Airports also provide tangible/visible results

Importance of Partnership

To get alternative fuel vehicles (AFVs) on the road and infrastructure placed, leveraging is the “name of the game.” Local and state governments need to get involved. Strong partners can help create successful projects. Clean Cities are a source of potential partners.

Federal Sources
Several sources of funding are ISTEA/CMAQ, DOE's State Energy Program, and DOE's Urban Consortium Program, which works with local governments. Tax incentives can also help, as do certain industry grants and EPA/DOE transportation solutions/grant programs.

CMAQ—What Is It?
CMAQ provides $1 billion/year for projects, and has provided $275 million over its life to AFV projects. CMAQ is administered by the DOT's Federal Highway Administration. New changes should occur in the new version of ISTEA. Working with Metropolitan Planning Organizations is a key to project funding.

CMAQ How to Guide
DOE has prepared a CMAQ "how to" guidance. This includes how to get to know your metropolitan planning organization, and how to know if money is available. In addition, the guide also explains how to find out if your project is consistent with the SIP, and explains the MPO application process. The guide also advises on selecting partners, developing projects, and submitting the information.

DOE State Energy Program
DOE also has an annual solicitation under its State Energy Program. The program has provided $6.7 million in funding during the last three years. It will provide $2 million in 1998. Funds come through state energy offices, and Clean Cities are the catalyst for the funding.

Tax incentive information is contained in the Clean Cities funding guide; other resources are available on the web sites and from DOE's hotlines.
DOE Hotlines: 800-423-1DOE; 800-CCITIES. FHWA: 202-366-2080
DOE Web sites: www.afdc.doe.gov; www.ccities.doe.gov; www.eren.doe.gov

Session Q and A

Can airport owners share or transfer funding to fleets or airlines?
Dave Field: It is possible for airports to use their own revenue to lease back equipment, but they cannot direct transfer grant funding.

Camille Mittleholtz: Federal highway division offices are in every state. Good way to get information on funding issues.

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Session IV(A)—Model State and Local Incentives Program

Why Use Alternative Fuels?
Alternative fuels can help with air pollution mitigation. Alternative fuel vehicles (AFVs) can work well at an airport because of short-duty cycles and limited range requirements. Also, airports have infrastructure advantages.

Clean Air Partnership Program at Logan Airport
EPA and the state are involved in the Clean Air Partners Program, as are several electric and gas utilities. Other program participants that helped launch the AFV ground transportation efforts are Enterprise Rental, U.S. Shuttle, Avis, National, Thrifty car rental agencies and Paul Revere Transportation. Landside efforts include American Airlines and Hudson.

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The Airport Authority converted 18 buses to CNG, and a new bus was purchased from an original equipment manufacturer (dedicated CNG). In addition 5% of the airport's ¾-ton trucks have been converted to run on CNG.

While the major advantage of CNG is that it is clean burning, CNG vehicles have limited range, refueling takes longer, and the CNG vehicles generally deliver less power.

The car rental facility has been moved closer to the parking structure. This has eliminated car rental shuttle equipment completely. The airport authority is

currently working with Mountain Fuels as its natural gas supplier and is using private and state incentives to help finance its purchases.

Vehicle Purchases and Credits
Currently, Utah has incentives worth 20% of the tax owed up to $500 for a new vehicle and $400 for a conversion. The state has formulated a loan program for new vehicles and conversions. It also provides loans for building new CNG refueling sites. Certain taxes are not collected on CNG and other alternative fuels; the cost of CNG is approximately 65 cents per gallon.

Salt Lake City Clean Cities Coalition/DOE/and Airport Authority
Major efforts of these groups include concentrating on using AFVs for going to and from the airport. The groups are surveying businesses to see what incentives they need to transition their fleets to alternative fuels. These groups are also focused on training for vehicle conversion and maintenance.

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Why Use Alternative Fuel Vehicles?
In the case of Oklahoma, AFVs carry financial incentives, perform well, and have greatly reduced emissions, and laws and incentives in the state support the use of these vehicles and fuels.

Oklahoma has a loan program, and offers a 50% tax credit for AFV conversion performed in the state. In addition, the federal government offers a tax deduction for vehicle purchases or conversions. So far the loan program has helped finance 300 AFVs and 8 refueling stations with some $1.6 million.

Programs in Oklahoma Clean the Air and Boost Local Economy
Public AFVs are in place with the U.S. Postal Service (largest USPS AFV fleet in the U.S.),Tinker Air Force Base (the largest Dept. of Defense AFV fleet), Oklahoma City, and Metro Transit. Many private fleets are also using AFVs.

Other activities in Oklahoma include development of training programs for converting conventional vehicles to electric vehicles. Oklahoma has 500 certified
AFV technicians and 17,000 converted vehicles (total). Will Rogers Airport in Oklahoma City has 2 alternative fuel ground support vehicles.

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The South Coast area is in extreme ozone nonattainment area. In 1994, California released an ozone SIP planning document. The area is in need of emissions reductions; new technologies and flexible programs can help.

Three Areas will be discussed in EPA's consultative process—emissions reduction from transportation sources, heavy-duty vehicles, (includes locomotives and mobile equipment); and issues related to aircraft and marine vessels.

Four working groups have been formed to address the various emissions reduction issues. These are Aircraft Emissions Standards, Aircraft Operations, Ground Service Equipment, and Ground Access Vehicles.

Environmental Effects at LAX
The effects of the emissions programs have led to ridesharing and carpool programs, employee trip programs, low-cost van pools, reduced rates for transit, vapor recovery on fueling stations, electric tram placement, 30 compressed natural gas (CNG) pickup trucks and transit buses at the airport. Future plans include more liquefied natural gas (LNG) buses and LNG truck tractors.

Local Programs --Mobile Sources Credits
Credits can be obtained for clean, on-road vehicles. Credits can also be obtained for clean, off-road equipment. United Airlines has 130 alternatively powered pieces of ground service equipment.

Summary
Alternative fuel vehicles are an important element of California's South Coast's air quality program. To make AFVs a part of the solution, it would be helpful to have an accelerated turnover of existing fleets. Voluntary alternative fuel use is more cost effective than command and control strategies.

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Session IV (b) Landside Light Duty Vehicles

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Introduction

SuperShuttle is a growing national leader in transportation service to and from airports. SuperShuttle's growth strategy includes adding both company-owned and franchises to serve the nation's top100 airports as well as increasing service in current markets. An opportunity exists to leverage off our reputation and brand leadership.

History of Alternative Fuels Use

SuperShuttle first became involved in conversion of its Dallas and Los Angeles fleets to propane in 1991. In Los Angeles, the fleet faced pressure from the South Coast Air Quality Management District. There was no regulatory/agency pressure in Dallas – the decision was made based on economic issues.

SuperShuttle continues to use propane in Dallas today but the propane fleet faced significant problems in Los Angeles that led to an agreement with Mesa Fuels in 1994 to provide compressed natural gas (CNG) and convert vehicles to CNG in Los Angeles and Phoenix. CNG technologies have advanced

significantly since 1991 and, in particular, Chrysler came out with a viable OEM product. As a result of both product availability and sufficient infrastructure development, SuperShuttle fleets were able to put in 150 OEM dedicated CNG vans in Los Angeles. By contrast, refueling concerns led to conversions of 65 gasoline vehicles to bi-fuel CNG in Phoenix.

Technical obstacles that appeared included the weight increase on vehicles and a problem with the CNG compressors that pumped oil into the fuel. The GFI conversion kits used had no tolerance for oil in the fuel.

Mesa responded by providing greater storage and inline filters. GFI responded by converting all vehicles from the GFI 1 kit to GFI 2 kits. However, it was still impossible to completely convert to 100% CNG.

The Los Angeles Airport CNG project is a resounding success. Easy use of the dedicated OEM vehicles was made possible by the more expansive fueling infrastructure in the area.

SuperShuttle is in no way discouraged by the setbacks experienced in Arizona. They're working to convert fleets in Sacramento and Washington, DC to natural gas as well.

"We must have cooperation. Airport staff, regulatory agencies, private companies must all commit to change and work together and eliminate the road blocks constructed by those who'd rather prevent change."

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Introduction

This presentation looks at why AFVs should be used for rental cars and examines car rental programs in place and other AFV programs.

Why Use AFVs as Rental Cars?
A rental fleet provides a "pool of on-site autos." Airports are like small cities, with 41% of the emissions coming from landside vehicle operation. Operation of rental vehicles is round trip and the average transaction is 3 days and travel is just 50-75 miles. Therefore, the majority of these vehicles never need to refuel. Often, there is a very light baggage requirement for this type of travel. Specifically targeting the correct users for AFVs will improve the chance of a program's success. In addition, the AFVs being rented provide visibility for the rental company and the individuals using the vehicles.

National Car Rental Program
A program was put in place at Burbank and Sacramento airports, using the Honda EV Plus and Honda Civic GX (compressed natural gas vehicle) for State of California employees only - this effort was very targeted.
Vehicles are not an obstacle if they have the correct range. The EV is an "image" leader, while the Civic provides a "practical" approach to vehicle rental. Fueling is always done by National Car Rental. The responsibility is never put on the shoulders of the renters.

Other Airport Programs
Other airport AFV rental programs have had mixed success. Denver faced several obstacles. They let John Q. Public use the AFVs without sufficient orientation/education. Some users were left stranded. Also, staff turnover created a gap in the learning curve.

In Palm Springs, there has been a very successful program. The MSA is smaller (average distance 22 miles). These renters are a captive audience—less likely to go beyond the range of the vehicle.

Product Offerings for Car Rental Program
- Electric Vehicles
  - Sedans are not yet widely available.
- Dedicated NGVs
  - Ford Crown Victoria
  - Honda Civic GX

Civic GX Emission Advantages
Emissions (NMOG) are just 1/10th California ULEV vehicles. Plus, NGVs have virtually no evaporative emissions, and have minimal marketing/refueling emissions.

Implementation
To implement a similar AFV rental program, carefully target customers; perhaps corporate partners would have the best potential. You also need targeted markets. A good idea would be to build a "how to" manual on implementing AFVs

into rental car fleets. Also, it would be wise to learn from the experience at the few airports that serve as models in order to do it right.

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Introduction

Currently there are 12,000 medallion "yellow" cabs in New York City. In addition there were 226 million riders in 1993, and cabs went over 750 million miles (accounts for 1/3 of midtown Manhattan's vehicle miles traveled). Furthermore, taxis consume an average of 5,000 gallons of fuel yearly each, and together emit 42 tons of CO per day, 6.8 tons of VOCs per day, and 6.6 tons of NO_x per day. There is a potential reduction of 50-80% with compressed natural gas (CNG) vehicles.

How New York's Taxi Program Works

Project partners in this program include CMAQ, New York City, New York State, Brooklyn Union, Ford, the taxi drivers, and the state of Texas. Fueling systems were purchased with CMAQ funds. The vehicles are owned by the state and leased to the taxi drives for a useful life (100,000 miles). Ownership reverts to taxi owners at the conclusion of their useful life.

How Can You Do This, Too?

It is necessary to come up with incentives to help drivers overcome the fear of new technology. One key city-policy change is that CNG vehicles were given a 2-year retirement extension. Gasoline vehicles must be retired after 3-5 years depending upon use. CNG vehicles can be retired after 5-7 years, instead.

Sustainability of Program Post CMAQ?

The lease cost is a 20% match required by CMAQ paid by each taxi driver, utility or other third party. The NYC Taxi Commission is handling program enforcement; taxis are inspected 3 times per year to assure program compliance.

Key Issue: SAFETY

Worst case test. Misinformation can set back programs - bad press can occur. An example, a headline read "This could have blown" --city bus horror came this close to major blowup" title of article

Airports
Getting an airport to work with a city government or a private utility is a constant challenge. But, sometimes there is recognition that this program is important and worthwhile. It's a market that makes sense. The next trick is to get drivers to use these vehicles and get comfortable with them.

Session Q&A
Who should be making the how to manual?
Steve Ellis: Honda will take the responsibility and is working with all groups.

Address the short life span of rental cars (used about 1 year). Any difference with the CNG vehicles?
Steve Ellis: It has been an economic stumbling block in the past with conversions. But with the growing number of OEMs, there is a greater effort to create a secondary market. The idea would be to come off of a lease/purchase by a rental agency into a centralized information resource to advertise the availability of the vehicle in advance. The customer is ready to take the vehicle as it comes off line. In Colorado, Crown Victorias were easily sold this way.

How old is the oldest CNG vehicle in the NYC taxi Program?
Mark Simon: The CNG dedicated taxi progam began in August 1997. It is being used as a perk. It is being touted as a new clean vehicle to good drivers.

Would it be worthwhile to charge the customers a premium for using the CNG?
Steve Ellis: No. It shouldn't be a premium despite the current incremental cost for CNG. The manual will be written with the future goal of equalizing the cost of the vehicles.

Remark on the Safety Issues with the CNG Vehicles in NYC…
Mark Simon: NYC taxi in accident was an OEM, built to withstand such an impact. Many conversions are not. It is important for buyers to look into this. An MTA representative had called it a "near disaster." We need to coach/educate them to put the right spin on it. There is a real need to train the media itself—a media advisory backgrounder will be provided.

Who's purchasing the cabs in NYC? (In Austin, the individual drivers have to buy them)?
Mark Simon: In NYC, 1/3 of the taxis are owned by fleets, 1/3 are owned by individuals, and one 1/3 are owned in a hybrid manner. Though it is more difficult to go door to door, it is actually easier to convince the individuals who have to do the actual fuel purchasing. There is a real need to make the fueling easier, user friendly, more like the gasoline infrastructure

Value of Medallions and other factors make NYC market unique. What do you do to make sure that the cab stays on the fleet. (i.e., not just bought or converted and then left in the garage)
Mark Simon: In NYC, drivers pay to get out of the program. Fines are implemented. A few withdrawals have occurred, but mostly because of trunk space issues. The new Ford Crown Victorias may alleviate this situation.

How is the insurance industry looking at this?
Mark Simon: There are no reported changes. Insurance companies have not singled these vehicles out and if they meet safety requirements, why should they?

How does variation in compression rates in fueling stations and variations in nozzle types affect use?
No problems found among the three groups.

One hundred Airports are targeted by Super Shuttle. How are they determined?
Brian Weir: The airports have not yet been determined. This is a lofty goal. They're trying to stay ahead of the curve. Many airports are looking to alternative fuels; most will in the future. SuperShuttle franchisees are encouraged, not required, to use alternative fuels. Their perspective is that they will have to do it soon. SuperShuttle will take advantage of doing it before they have to.
Problems exist everywhere to make it difficult, but they can be overcome.

Honda's plans?
Steve Ellis: We are studying geographical issues, terrain, and weather. We have no locked in targets yet. We are looking at how to overcome potential obstacles.

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Session IV[C]: Alternative Energy Sources for Airport Terminals

Airports have huge terminals and use up a lot of energy—there is a potential for large savings. Renewable energy technologies are needed in terminal buildings, and more efficient operating systems are also necessary. The "Million Solar Roof" innovation will spread the use of solar energy by 2010. Seventy thousand jobs will be created in the process. Atlanta is an example of how solar can work at large facilities; the Olympic pool had a photovoltaic roof.

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The electric utility industry is $700 billion per year in revenues. The industry has been well regulated and broadly structured. The industry is rapidly becoming an "energy" industry due to deregulation.

EPRI is 25 years old and represents some 700 utilities. Its activities are designed to open the production, delivery and use of electricity.

Significance of Electric Industry in Airport Operations
The electric industry has played a significant role in airport operations including communications, ventilation, and movement of people. Furthermore, it is used in baggage and cargo handling, food service, and as a means of auxiliary power.

What the Electric Industry Can Do For Airports
In summary, EPRI is working with 7 airports and 2,000 vehicles. It is working toward enhanced indoor air quality, power quality, ground support equipment, food service and waste products management.

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Introduction
Solar is a cost-effective solution for airport terminals. Hot water, and [**HVA]** for the hangar can have a solar application. The solar industry welcomes a restructured utility environment in which to do business. Solar thermal technology costs 6 cents per kilowatt hour, while photovoltaic costs 12-26 cents per kilowatt hour.

There are some myths about solar technology. It is regarded by some as a "hippy" technology, and some believe it costs too much. Another myth is that solar can't compete in a restructured utility environment.

Economic Case Studies
Solar has proven to be economic in a number of facilities including Sacramento, CA. The Sacramento Metropolitan Utility District has a solar portion in a 300 foot x 14 foot covered parking garage. A photovoltaic system is being used for recharging electric vehicles (EVs) in an Orlando, Florida parking lot. Also, the San Juan municipal airport is using photovoltaic applications. The Solar Energy Industries Association is working with EPA and DOE to change rules regarding SIPs and credits.

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Session IV(d): Airside Vehicles

Click here to view Alison Bird's presentation.
[Place Content of Alison's speech here]

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United Experience
United has experience with electric vehicles, natural gas vehicles, propane vehicles, and clean diesel. The airline has the most experience with electric vehicles.

In addition, United has used alternatively powered bag tractors, aircraft pushback tractors, beltloaders, and general personnel carriers. United had found the most impractical part of the operations has been with EV recharging.

Economics
United's experience is that AFVs are higher cost, but generally have a lower annual operation cost. The payback on the vehicles is sometimes as low as 3 years.

Limitations of EVs
For its purposes United found problems with EV lead-acid battery technology, and had complaints about range and duration of use. Anticipated improvements in these areas have been unfulfilled. The infrastructure can work out well when new terminals are built and lots of recharging is added, such as in Denver. Existing airports don't offer enough in this way.

CNG Experience
United operates CNG-powered equipment in Denver, Los Angeles and San Francisco airports. The emissions have not proven as low as anticipated, and difficult maintenance issues have occurred on converted units. The factory-built units have been better in terms of maintenance and emissions. Range and the location of tanks have limited this equipment. United is concerned about tank safety.

Summary of Obstacles to Alternative Fuel Ground Service Equipment

To reiterate, the obstacles to alternative fuel ground service equipment are; lack and cost of infrastructure; lack of funding for research and technical improvements; the equipment market size is poor and because there is not a major market there are limited OEM offerings. Also, the life of the product is less than that of conventional fuel types.

Current strategy
Again, United will use electric powered vehicles where it is technically and economically viable. Clean diesel will be used for long range high applications. United will rely on proven automotive technology, where possible. A real need exists for product reliability and ease of maintenance.

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Introduction
TUG will not "lead" the market; that strategy is not cost effective. TUG will wait until demand is there and the customer asks for the products.

The history of performance has been good with OEM offerings; TUG wants to sell more, and will respond to needs. TUG is concerned about upcoming regulations and wants to be ready. "We will be there when needed."

Products Available
TUG is already meeting some of this demand with its MA Tractor that is made in gasoline, diesel, propane and CNG models; 12,000 have been sold worldwide.

In addition, TUG sells the M1 low profile tractor running on a choice of four fuels, and sells belt loaders in models that can be powered with a choice of gasoline, diesel, liquefied petroleum gas (LPG) or compressed natural gas (CNG).

TUG also sells an electric tow tractor. This vehicle helps with emissions in underground tunnels. It has a low center of gravity, which is good for the drivers.

Summary
TUG is a customer driven company; it saw the need for alternative fuels and responded. TUG now has alternative fuel vehicles available.

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Introduction

Edison EV is a distributor of electric vehicle charging equipment. Edison EV does off-road installations.

Edison EV participated in the Ontario electrification project that began in 1994. The company had a partnership with Southwest Airlines and U.S. Electricar. The goal was to convert 5 vehicles and insert more for testing. These vehicles would be demonstrated for use as ground service equipment. Funding for the project came from the air quality management district. Southwest Airlines supplied the vehicles, Edison EV installed the infrastructure, and U.S. Electricar performed the conversions.

Much coordination was needed to get this project going. Coordination needed to be done with the Department of Airports, the local building inspector, the installation contractor, the tug manufacturer, funding sources, and the utility. The fleet manager managed this entire effort, which is not an easy job.

Several infrastructure issues, such as the lack of standardization and underwriter's laboratory approval on connectors, proved difficult.

Lessons leaned

- Coordination of efforts is complex—there are too many players at airports to get anything done quickly--the need for a good project manager is very high.
- The scope, project and people working on the effort should be well defined.
- A well-defined schedule should be set, including incentives for meeting deadlines.

Day 2: Clean Airport Summit: Powering Operations with Alternative Fuels

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Session V(A): Aircraft Operations and Technology

Why Look at Airport Emissions?
EPA's role has been to set new engine standards. EPA has been involved historically in what airports do (i.e., California federal and state implementation plans and national standards, etc.).

Energy consumption is an issue, as is increasing pressure on airports to be good neighbors. Other major airport issues are safety, climate change, scheduling of cleaner planes, and fuel costs.

The big questions: What is the impact on airport operations, and what are we going to do now and into the future?

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Delta saves money when it saves fuel. At the same time, airline fuel conservation equals reduced emissions. Fuel consumption is currently almost 13% of Delta's total expenses.

He discussed the fuel savings potential and airplane improvements using old and new procedures, for example, the Federal Aviation Administration's route program and "cruise climb."

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Where We Can go Forward

Fuel efficiency trends, as a result of new engine configurations, have eliminated a lot of the unburned hydrocarbons. Pratt & Whitney has been able to meet the NO_x regulations. Because of global warming the focus is CO_2. The local concern is NO_x. Manufacturers have been pulled from both directions.

Improving operational measures would improve NO_x by 17%. There has been a technology breakthrough by improvement of engine pressure ratio (a NASA program). Ultra low NO_x reductions are issues for manufacturers. They want to continue to strive for fuel efficiency while pulling down on all emissions, not just NO_x.

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Click to view Paul Helliker's presentation.
[Insert Paul Helliker's presentation here]

Session Q & A

Speak more about the dual combustor engines.

Respondent Unknown: Stage combustors have delivered about a 32% NO_x reduction with a 6% fuel savings. The larger engines haven't seen these results, it's been disappointing as we get to the higher combustion engine. Data so far on the 777 haven't been that successful.

Has anyone looked at the fuel parameters?

Respondent Unknown: Yes. We are looking at how to reduce sulfur, however, given the infrastructure we are looking at a kerosene based fuel. We are not sure that additives are the solution.

Single engine taxiing, does that pertain both to arrival and departure?

Respondent Unknown: Bigger aircraft don't tend to do this. The answer depends greatly on the airport and the type of planes.

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Session V(B): Landside Heavy-Duty Vehicles

Introduction
This session will examine how to reduce emissions from two interrelated activities at airports—landside heavy-duty vehicles and movement of goods.

Most airport emissions come from vehicles around the airport. Of those, heavy-duty diesel trucks account for the majority of NO_x (37% v. 30% passenger vehicles, 12% heavy-duty gasoline trucks, 13% light trucks, 6% medium-duty trucks, 1% urban buses and 0.47% for motorcycles.) Heavy-duty trucks' contribution to PM-10 is 54% in California.

Diesel Trucks Source of Most Hazardous Air Pollutants
Fine particulate matter is responsible for as many as 64,000 deaths, 3% of all mortality in the United States. In addition, fine particulate matter increases mortality in the country's most polluted cities by as much as 17%. California is currently considering classification of diesel exhaust as a human carcinogen; studies of truck drivers and mechanics indicate as much as a 50% increase in cancer rates. The American Lung Association estimates annual health costs in California, Nevada, Utah, Arizona of exposure to PM-10 at over $5.9 billion

Cause of Death, United States, 1996

Heart Disease:	743,460
Lung Cancer:	154,183
Pneumonia:	81,776
PM:	64,000
AIDs:	46,050
Breast Cancer:	43,910
Traffic Accidents:	41,893
Prostate Cancer:	41,000
Homicide:	26,009
Hepatitis:	2,489

Upward Pressure on Diesel Users

There is increasing evidence that diesel is the source of most health-threatening air contaminants. Current and projected diesel emissions control programs are insufficient to achieve current ambient air quality standards. The new National Ambient Air Quality Standards shift focus onto diesel (PM-2.5). New heavy-duty engine standards will be in place in 2004.

Cargo Explaned & Deplaned, 1996 (in metric tons)

Memphis	1,933,846
Los Angeles	1,719,449
Miami	1,709,906
New York-Kennedy	1,636,497
Louisville	1,368,520
Anchorage	1,269,283
Chicago/O'Hare	1,259,858
Newark	958,267
Atlanta	800,181
Dallas/Ft. Worth	774,947
Dayton	767,255
Oakland	615,298
Indianapolis	609,450
Philadelphia	499,532
Honolulu	436,165
Boston	405,582
Ontario	369,485
Denver	389,899
Seattle	388,218

Obstacles to Reducing Emissions from Goods Movement

It is difficult to ascertain which fleets haul cargo to and from airports; managers don't work directly with cargo fleets, and airports have limited information about carriers that operate locally. Except for package delivery companies, airports don't require specific licenses. Most air cargo is contracted through freight forwarders (intermediaries between customers, airlines, and freight haulers).

Freight Forwarders

These are the travel agents for freight. They contract with hundreds of fleet operators who are single owner-operators or lease their trucks. Freight forwarders estimate there are between 2,000 to 3,000 of these companies operating just at LAX. It is difficult to find a comprehensive listing of freight companies operating in any given airport - they change too often for such a directory to be useful. Most cargo companies at airports contract for drivers and vehicles on an "as needed" basis. To avoid under utilization, there is a shortage of fleets that own their vehicles. Much of the cargo activity at airports is with contract carriers or leased trucks; routes vary widely. It is rare for a company to operate a regular route, and it is particularly difficult to manage infrastructure needs, and hard to plan fueling.

Obstacles to Reducing Emissions from Goods Movement

There is a limited selection of truck fleets that are large enough to deploy an alternative fuel vehicle program economically. Even large carriers don't operate a lot of trucks at airports and they are not generally based at the same depot. Many large carriers don't have dedicated fleets. Also, most cargo companies at airports contract for drivers and vehicles on an "as needed" basis to avoid under-utilization and fleet maintenance costs. Thus, there is a shortage of fleets, which own their own vehicles—much of the cargo activity at airports is with contract carriers or leased trucks.

Another obstacle is that routes vary widely—it is rare for a company to operate a regular route. Most fleets do not operate the mileage necessary to make liquefied or compressed natural gas (LNG or CNG) vehicle use cost effective.

It is also found that fueling practices vary widely—most fleets fuel at dispersed locations along routes. In addition, these fleets have notoriously low turnover rates—contract carriers lease or purchase used trucks and operate them for many years.

Another obstacle is limited awareness about AFVs among fleet operators. Opportunities are primarily around gaseous fuels (CNG, LNG) and liquefied petroleum gas (LPG). The focus is on package delivery companies with the highest concentration of vehicles around airports. Another focus is on airline trucks that carry freight from aircraft to cargo warehouse. These types of fleets may develop opportunities for public/private partnerships for shared infrastructure

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Introduction

The U.S. Postal Service (USPS) is responsible for 208,000 vehicles. All environmental issues are linked back to the business, starting with the vehicle fleet. "We will foster the sustainable use of natural resources."

USPS was first involved in alternative fuels in 1899 with the use of an electric motor carriage in Buffalo, NY; it was a business decision

The USPS has traditionally been overwhelmingly dependent on gasoline. Currently, USPS has about 7,200 alternative fuel vehicles (AFVs) in its fleet. Of the current AFVs, most operate on compressed natural gas (CNG), while a few run on methanol. USPS sees CNG's advantages as lower emissions, lower fuel cost and less vehicle maintenance. The downsides from USPS' perspective are higher-cost vehicles and lack of infrastructure availability. Electric vehicles also have some advantages such as zero emissions, lower fuel cost and less routine maintenance.

USPS does not want to be in the fueling infrastructure business, they want to partner with others; this conference is ideal to make those linkages.

Where Is USPS Going?

In 1998, USPS will be required under the Energy Policy Act to acquire AFVs for 50% of its new vehicle purchases and leases. In 1999 and thereafter, the amount grows to 75%.

USPS sees both challenges and opportunities, plus a chance to be an environmental leader. USPS can use AFVs and reduce its costs and present a positive image.

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[Insert Bryan Henke's speech here]
Freightliner builds a low-floor CNG/diesel shuttle bus chassis estimated to be the greatest demand type.

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History of Denver International Airport Alternative Fuels Program:
An agreement was established that within 15 months that all concessionaires had to use alternative fuel vehicles (AFVs). In 1994, a waiver was given to heavy- duty truck operators because there was no suitable AFV. This is no longer the case. There is an increasing variety of AFVs available for airport activities.

Currently at DIA there are 145 CNG powered vehicles which includes passenger cars and 40-foot transit buses. On order are 10 E-350 Ford vans that will run on CNG, and DIA will add 14 heavy-duty CNG transit buses in the next year.

Noise, diesel particulate pollution and concern over use of fossil fuel are all key factors in the decision to promote alternative fuels at DIA.

Cooperation between airlines, airports, and concessions really need to be there to make a project like this work. "If you all work together, you can make an airport clean."

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Biodiesel Facts

Positives	***Negatives***
No infrastructure changes	High cost of fuel
No added vehicle costs	3-5F higher cold flow (viscosity)
Domestic and renewable	Poor distribution network
Cleaner burning	Deteriorates rubber
Non-toxic	Deteriorates concrete
Adds lubricity	

Biodiesel tractors in parks can be an ideal application—they eliminate odor. In St. Louis, 52% of VOC emissions are from both on and off-road mobile sources.

Goal: To get to 10% and 30% replacement fuel goals under the Energy Policy Act. Biodiesel is a key; it is an economically viable option to achieving these levels.

B20 (20% biodiesel/80% diesel) is part of a successful strategy. There are many applications with biodiesel the 8,500-26,000+ gross vehicle weight categories.

Three airports currently use biodiesel: Lambert St. Louis International Airport; Indianapolis International Airport; and Logan International Airport in Boston.

For more information on biodiesel contact:
- National Biodiesel Board: 800-841-5849
- Clean Cities Hotline: 800-CCITIES, www.ccities.doe.gov
- Energy Efficiency and Renewable Energy Network: www.eren.doe.gov

- Environmental Protection Agency: www.epa.gov
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Session V[C]: Aircraft Operations

Introduction
The Sacramento region exceeds air quality standards. Sacramento International Airport is required to operate a State Air Quality Certificate (AQC) because of its additional runway. The AQC limits airfield operations. As a result, the airport needs to implement a unique air quality program.

The limits under the AQC are 7 million annual passengers, 139,000 aircraft operations, 11,800 permanent parking spaces and an annual compliance report must be submitted. A new AQC will be needed.

On-Going Proactive Efforts
The Department of Airports is encouraging voluntary actions. It is encouraging employee and patron vehicle trip reductions, and less emissive aircraft and operational procedures. Furthermore, DOA is utilizing low emission AFVs and equipment, providing alternative fuel infrastructure and quantifying resulting pollutant reductions.

Landside Alternative Fuel Applications
DOA vehicles include 18 compressed natural gas (CNG) shuttle buses; 13 flexible fuel sedans; 11 CNG trucks and vans; 4 electric utility vehicles; 1 electric shuttle bus; and 1 methanol bus.

Infrastructure
Current alternative fuel infrastructure includes public CNG refueling, public recharging for electric vehicles, photovoltaic solar panels for recharging; and airside liquefied petroleum gas (LPG) and methanol refueling stations.

Airfield Design and Infrastructure to Minimize Emissions
Design features and infrastructure is set up to minimize emissions. Some of the features are: centrally located terminals; parallel runways; high speed turnouts; new gates closer to the East runway; 400 Hz + PCA; and recharging for electric ground service equipment (GSE).

Basics of Jet Engine Emissions
Low power settings yield high carbon monoxide (CO), high hydrocarbon (HC) and
low NO_x emissions. High power settings yield low CO, low HC, and high NO_x.

Successful Aircraft Operational Procedures
Sacramento eliminated gate "power backs." The second runway/taxiways have streamline ground movements. Also, aircraft is towed to overnight parking and voluntary reduced engine taxiing procedures for inbound flights is instituted. In addition, there are bridge-mounted 400 Hz PCAs, and alternative fuel use (with much more planned).

Typical Constraints Found at Other Airports
Most airports are older facilities, and major upgrades are needed to efficiently accommodate more capacity. Land may not be available for these upgrades, and major funding is need for alternative fuel infrastructure development and improved facilities. In addition there are other competing issues.

Lessons Learned—Airfield
Airfield infrastructure improvements can yield time, fuel and emission savings.

Enforcement of new procedures is problematic and staff intensive. Large capital investments are required to make changes. Airports should have contingency plans in case their plans don't work. And, some pollutants may be reduced at the expense of others. Detailed numerical analyses are required by <u>all</u> parties to quantify benefits

Recommendations—Airfield
Determine causes of "bottle necks" both in the air and on the ground. Manage them, in the near-term, with existing facilities as well as possible. Then, plan long-term facility and infrastructure improvements to minimize delays. Also, establish passenger facility charge (PFC) funding criteria in reduced emission technologies

Recommendations—Alternative Fuels
It is important to develop objective approaches to determine cost effectiveness. More demonstration programs are needed and much more funding is required. Communication among industry and government is necessary so no one duplicates failures. Peer-reviewed articles on these issues should be published in accredited journals. "Get it down to a science."

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Natural Resources Defense Council (NRDC) examined ground level air carrier emissions at nine airports in 1993. NRDC reported about airport pollution in its study "Flying Off Course."

Furthermore, NRDC found the first state implementation plans (SIPs) varied from state to state. "We looked at the top 50 airports and 3 in Southern California. Federal law is the reason why aircraft emission control has made it slip through the cracks. The certification standards don't accurately tell you what these engines are doing."

To understand the emission problems, NRDC looked at emissions below 3,000 feet, and examined commercial flights. Its main findings: most of the NO_x is created when the aircraft is climbing out; 93% of the VOC emissions happen at ground level; and airports are significant sources of VOCs and No_x, especially when compared to other large stationary sources. Airports should be treated as area sources--airports, airlines and states can take steps to reduce VOCs. For example airports can take measures to use alternative fuels, electric gate infrastructure, and replace stage II aircraft. Airlines can reduce idling and taxiing emissions by shutting off all but one engine during a significant part of taxiing and idle time.

Delta has guidelines for single engine taxiing and has saved $5.9 million/year at the Atlanta airport alone. NRDC looked at other airlines and found, for example, America West at its Phoenix hub could save $1.2 million/year. A case study of the Newark airport using 1993 data, under a Delta "scenario", found a potential reduction of 300 tons per year (tpy) VOCs and 100 tpy of NO_x. Transportation control measures are equal to 1.4 tons per day in the New Jersey SIP.

How to implement "Delta Scenario"

First, leadership is needed at the federal level. The Environmental Protection Agency needs to issue guidance on how to take SIP credit for strategies. The Federal Aviation Administration needs to put out an advisory circular. Airlines

and airports need to change pilot behavior, and states need to work with airlines and airports to incorporate these strategies into the SIP.

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ATA wants to operate airplanes as efficiently as possible, but safety concerns are important; pilots need flexibility.

Air travel is very safe, and decisions have to be made on safety first. In terms of operational efficiency, 737s are 39% more fuel-efficient than 727s.

The key is operational flexibility. This reflects the pilot's need to keep control for safety. In 2-engine airplanes during taxi all thrust occurs on one side, this is okay if the taxiway is dry. Air conditioning is compromised with engine shutdown.

ATA would like to form operational teams to discuss issues such as single engine taxiing.

Comment: Quentin Smith – Federal Aviation Administration
Balancing environmental needs with safety is important. Operational strategies have safety implications. Fuel dumping can cause environmental problems, but safety judgements will prevail. A continued dialogue about these issues is important.

Session Qs & As

Sacramento data suggests that single engine taxiing can increase NO_x?
Jim Humphries: In some cases, thrust went up so NO_x increases; FAA software doesn't assume this scenario. The issue is a function of traffic and taxi distance.

Do hush kit retrofits increase NO_x because of increased thrust?
Unknown Respondent: We don't know; there is not enough data. This also may differ by engine.

Airplanes are high occupancy vehicles, air travel is better for emissions than cars. Fuel conservation saves airlines money.

Al Prest: Efficient operations are in the airlines' best interest. For example, overweight landings are now allowed to avoid fuel dumping during return to the airport.

Richard Kassel: Comparing mode shifting is difficult. Airports are a large source of emissions - every source has to do its fair share. The difference among airlines in how they encourage the "Delta Scenario." Why not treat this issue the same as noise abatement procedures?

Why create a rule to give pilots discretion they already have?
Richard Kassel: Rules should be written that allow states to take credit for reduced engine idling and other strategies. Airlines need FAA guidance.

Albert Prest: Guidance needs to be written by people who understand the issues as well as consider local conditions.

Who did NRDC talk to at the airlines and is the data available?
Richard Kassel: The report is footnoted and peer reviewed by EPA.

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Session V(D): Airside Vehicles

The New York Port Authority has a grant program. LaGuardia and Kennedy airports are working with the port authority. They are getting grants to put in a compressed natural gas station. LaGuardia has 130 different pieces of ground service equipment. It is difficult to sell alternative fuels to operators, who need to think of 6-month time frames and can't easily be persuaded on longer-term perspectives.

Meanwhile, airports face constant criticism from their communities regarding development leading to increased noise and pollution. Efforts like these, to

purse initiatives to clean airports, can help to improve relations with the community.

Airports constantly need to know what the airlines are planning to do. Airports are responsible for infrastructure – which, of course, is affected by plans/activities of airlines.

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Alternative Fuels Technology Developments
The industry is still learning to control oil out of compressed natural gas (CNG) compressors. We are in the process of how to best use the technologies that are here today, and how to get new technologies.

We have a good history of working with airlines and airports. Emissions testing on vehicles and certain standards were established to permit vendor activity. Previous problems have included unsophisticated, under-powered controllers. In the last 5 years we have seen a great growth in electric equipment.

There have been lots of bumps in the night. A lot of lessons learned the hard way. We need to get these lessons out to help followers.

With electric vehicles, our concern was initially whether electric equipment would perform as well as gasoline vehicles. Basically, the speeds are equivalent and performance is great. The electric vehicles always start in cold weather, never need antifreeze, and never need to change oil.

Initially, there was operator resistance to this technology. But in the last 3 years, there has only been one operator complaint. The operator rolled over his own foot.

The need for electric vehicles was initiated years ago during the oil crisis. As oil prices dropped, the need for electric vehicles has diminished – unlike in Europe.

Cost of Electric Equipment
The cost of the electric equipment is more than double that of traditional equipment. Our information shows that the actual fuel cost per day to run an electric powered baggage tractor is $1.71, versus a gasoline tractor that uses 7 gallons of gasoline at $7.00. That produces a daily savings of $5.29. It is estimated under these conditions, the payback for the equipment is about 1.53 years. Other estimates have shown a longer payback of 3-4 years.

Session Q and A
What is the life of a battery? What is the cost of disposing?
Curt Dallinger: The warranty on batteries is currently 6 years. The airlines keep batteries for 10 years. The battery producers recycle them; the cost of disposing/recycling built in to the cost of the battery.

There are revolving funds in various states to help pay for incremental costs (for instance through recouping of savings in fuel costs). If such a program was established on a national basis, would it help influence airlines' decisions to take these steps?
Respondent Unknown: Yes, it will influence them, but not greatly. It's still a larger policy decision, requiring authority that involves technical decisions, such as getting enough power. The availability of power and cost differential are the two greatest obstacles.

Why does it cost so much?
Curt Dallinger: Without recharging equipment, the cost is only about 10-15% more. Recharging equipment adds a high cost. Incremental costs are recouped through lower fuel and maintenance costs starting the first day of operation.

What about fast charging equipment? Is that an option? What about battery management option?

Curt Dallinger: We will look at the fast charging equipment as it develops. We are not currently looking into battery management. There is a slow turnover of equipment and there is resistance to changing often. Currently equipment is turning over every 20 years; some may even be going faster than that. Therefore, technology is being introduced more slowly.

Is there going to be enough demand?
Respondent Unknown: Without a doubt. The industries as they are today will not be able to meet the capacity of demand for these vehicles.

Based on today's technologies, how would you describe which technologies work best in which applications?
Respondent Unknown: Short-range machines are perfect for electric applications; long-haul, big-engine vehicles will operate on compressed or liquefied natural gas.

Findings and recommendations of the Aircraft Operations Brainstorming

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Obstacles to reducing emissions

- Most airport facilities are older, have limited land space and limited funding available for infrastructure improvements. Emissions reductions are not a high priority for capital investment projects.
- Not enough infrastructure and expensive initial investment
- Concerns regarding reliability and safety of AFVs
- Emission benefits from some AFVs can be small or negative depending upon operating characteristics of vehicle and pollutant
  * Certification standards also do not accurately portray engine activity
  * Increased idle time increases emissions of hydrocarbons and carbon monoxide
- Not enough funding available for AFVs
- Not enough communication and partnership among those manufacturing/marketing AFVs and airport/airline fleets
- Not enough concrete data to understand the science, technologies, applications, costs, and benefits of AFVs especially regarding their emission benefits/no manufacturer support
- New equipment and technologies require more money, staffing, and time
- Sentiment that airports are being "targeted and punished" for emissions from sources over which they have no control. For example in the realm of transportation conformity and airport expansion, there are thousands of entities/parties that must become a part of the process. But where does one draw the line? Complexity of the problem has resulted in environmental problems being avoided.
- Federal 1978 deregulation of airline industry and a Clean Air Act that dictates more reductions from all emitters creates a collision course for airports.

Recommendations

- With new, more stringent air quality standards, airports/cities can no longer put off this issue in spite of its complexity.
- Air quality not energy security will be controlling issue for airports. EPA and air administrators must clarify what they want and work with airports/airlines to find optimal methods for achieving their goals; should then go directly to FAA for funds to implement needed projects
- To make sound decisions on how to proceed, air administrators need a methodology for collecting air quality data including:
  * Accurate baseline planning is necessary.
  * Measuring ambient air quality concentrations at various airport locations instead of averaging emissions for the total site.
  * Determining who is generating on-site emissions and where they are being generated
  * Developing emission inventories above 3,000 feet because inversion layers may not limit transport

Technology and science dilemmas

- Controlling CO2 can increase NOx and visa versa. Can create scientific impasse between global (CO2) and local (NOx) issues.
- Many scientific questions that must be addressed first to ensure that we pursue
  the correct policies and activities.
- There is a trade off between NOx control and fuel economy. Must be aware of unintended consequences of certain technology control strategies.
- Emissions trade-offs. Swiss air engine that reduced NOx, ended up increasing emissions of other pollutants.
- Need to assess the status of technology, its applications, and ability to address airport air issues.

Recommendations for reducing emissions from aircraft operations

- Best option is to reduce fuel burning before 3,000 feet in the takeoff and the takeoff/ landing operations.
- Improved traffic control so that airplanes are not waiting to land. Easier to control airplane traffic than the vehicles. More holistic approach to aircraft operations can help achieve air quality goals even before advanced technologies are developed
- Reducing engine operating times will also help to reduce emissions
- SIP credits should be provided for achieving voluntary emission reductions
- There should be more gate electrification/400hz power should be provided at all gates
- Providing preconditioned air to airplanes will also reduce emissions from ground service equipment/ auxiliary power units

- High speed taxiways and improved access to gates will reduce aircraft idling time

Policy challenges and recommendations

Cities are increasingly ignoring development management issues. Need Federal assistance to work out conflicts between public access to airports and air quality. Problem needs to be addressed with regional perspectives and solutions.

Fuel cost is a key factor in reducing emissions. If airlines can find a safe way to reduce fuel use, they will. Studies have, however, shown that if airlines faced significantly higher fuel costs their choice would be to reduce short distance service - costing many jobs.

Congress should be encouraged to fund implementation of better air traffic control systems.

- Need more funding/ better access to existing funding for air quality improvement programs.
* FAA is maintaining an airline ticket-tax "fund". FAA/ airlines want the funding to be used for capital improvements but some of this money does not get used. FAA rather buy runways than emission reduction strategies and they have the final word.
- More FAA grant money can/ should be used for air quality projects

* FAA Part 150 noise mitigation initiative - it should allow airports to use some of these funds for air quality improvement projects
* CMAQ funding situation is similar. Money not necessarily directed to best emissions reductions projects. Airports should seek those funds, which in some areas are not being expended.
* Congress should create a CMAQ like program that forces greater emphasis on air quality initiatives. Program brought the right players to the table. Should designate some part of such funds specifically for air quality improvement programs.
- Need better agency coordination and participation
  * Need for greater coordination among federal agencies. EPA should be working more closely with FAA, DOT/CMAQ.
  * Lack of FAA representation at Summit is a key indicator of the problem
  * The current regulatory environment has made it very difficult for airports to expand and make needed improvements to address demand, increasing emissions. For example: Sacramento airport was not allowed to construct more parking because the local Air District wants to promote mass transit. But without enough parking or convenient mass transit, people are driving even more.

* Conversely, regulatory agencies are saying that just like highways, if you expand, more will come.
* Education, greater planning, greater coordination would benefit everyone.

Process recommendations and models

- EPA South Coast Consultative Process has been very effective. Post FIP, SIP Consultative Process in Southern California has taught/shown EPA a lot. EPA is not going to be able to come up with the answers/policies. Community is going to have to make the choices for itself
- Parties must determine whether dialogue should be at the national or regional level and who should be invited to the table.
- Should consider ATA offer to increase dialogue and create partnerships through:
  * Peer review of technical papers;
  * Development of an airport emissions working group (group already exists for global emissions as part of the Environmental Committee); and
  * Airport manager's groups that already meet monthly.

Findings and Recommendations of Airside Vehicle Session

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The following technological issues must be addressed to increase the use of airside AFVs at airports:

- Infrastructure must be expanded
- More AFV equipment offerings are needed
- AFV products must be made more reliable and equipment standards toughened
- AFV equipment costs must be lowered
- The capabilities of electric vehicles (e.g. battery issues) must be improved
- Reliable retrofits must be better designed
- Product lifecycles must be expanded
- AFV technologies must be more standardized
- The need for constant equipment maintenance must be reduced
- Parts availability must be improved
- Need better AFV technology for long-haul engines

- Tank safety and location issues must be better addressed

Many other miscellaneous issues must be addressed to facilitate expanded use of AFVs

- Must know more about obstacles to and opportunities for expanding the use of AFVs and "lessons learned" at other airports
- More Federal/private sector funding is needed to improve AFV technology.
- Must boost availability and gate access to power (grid issues)
- Emission benefits must be better documented.
- Better training is needed for those using and maintaining AFV equipment.
- Manufacturers must provide more reliable vehicle technology.
- Initial capital costs must be made more reasonable and easier to justify (most operators think short-term and are not easily persuaded by long-term economics).
- Because learning curve is long, constant education and marketing is key to expanded use of AFVs at airports.

Findings and Recommendations of Landside Brainstorming

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Key inhibitors to expanded AFV use

- Limited fueling infrastructure
- No resale market for used AFV vehicles and equipment
- Equipment market is poor with low volume and limited offerings
- AFVs have limited product life. Need more reliability and easier maintenance
- There is uncertainty of future technical support from equipment vendors and OEMs.
- Poor parts availability for maintenance of vehicles and fueling systems

- Limited funding for early purchasers of AFVs and limited funding for research and technology improvements
- Need more coordinated effort by marketers because of the many players involved in selling AFVs to airport fleets
- Need better marketing and education to overcome initial operator resistance

Vehicle electrification issues

- Must expand availability of power (grid issue). Getting the electricity to power gates and equipment can be costly/difficult
- Extensive cargo electrification seems unlikely because vehicles operate too far from gates
- Charging systems need to be better standardized to meet charging needs of all electric vehicles
- Electric vehicles can cost more than twice as much as traditional vehicles.
- It is difficult and costly to retrofit vehicles to electric power.

Natural gas vehicle issues

- Vehicles achieve less than expected emissions reductions in certain applications.
- Limited vehicle range and tank location issues limit trunk capacity.
- Fuel tanks present safety concerns

Special challenges in technology development

- Must design and locate tanks to avoid loss of trunk capacity in vehicles (taxis)
- Must increase the travel range and duty cycle of the vehicles
- Must fund more research on natural gas turbines that generate power and automated technology systems (ITS)

Need more data on AFV travel and fuel consumption patterns, and on how AFVs can benefit users

- Data collection is a special problem for the “for-hire” industry. State and federal regulations limit collection of data from independent contractors to protect their proprietary relationship with their clients. Must find method to overcome this hurdle, collecting data on fleet vehicles as they enter the airport.
- Need data on number of vehicles per shift (e.g., taxies, buses, and shuttles) to make sure that AFVs can meet the needs of the fleet
- Clean Cities should facilitate meetings to coordinate data collection at the airport sites.

- Some kind of cooperation between airport and regulators is needed to make sure that data, which is collected, is kept up to date.

Factors that compel the expanded use of AFVs

- Mandates
- Profit/cost savings to fleets
- Financial incentives from the government or private sector
- Need for airports to expand and minimize adverse impacts (AFVs can be a valuable mitigation strategy)

Recommendations for boosting use of landside AFVs

- Must establish more corridors with card reader systems to boost infrastructure access and create more shared infrastructure
- Must expand compatibility among fueling systems increasing their ability to fuel different types of vehicles using the alternative fuel
- AFV advocates should invest the time to better understand and adjust how airport revenues are collected and spent (for example: fees collected by the airport from landside vehicle fees is often used to fund airport capital improvement projects).
- Airports should use some of their financial mechanisms to stimulate the use of AFVs (for example, reducing “loop fees” to reward those fleets that use alternative fuels)
- Airports should establish parking policies that reward those using clean fuels vehicles or car pooling
- Need guidance from EPA on how AFV fleets can bank and cash credits for emission reductions via the state implementation plan process
- Utility user taxes should be eliminated for alternative fuels and vehicles
- Loopholes should be removed under EPACT and the CAA, which exempts smaller fleets from the regulations.
- AFV mechanic training should be more standardized.
- The Clean Cities web site should be better used to get information out about the location and specifics of AFV infrastructure
- Need to develop more information on AFV benefits and lessons learned and do a better job of getting it to fleets and organizational decision-makers
- AFV proponents must do a better job of educating fleets and decision-makers about potential cost savings in spite of the higher up - front initial capital costs of AFVs
- DOT, EPA, and DOE must create a coherent management policy for improving air quality at airports. Need more Federal leadership. Should seek assistance from John Horsley, Mary Nichols, and White House through an interagency meeting.